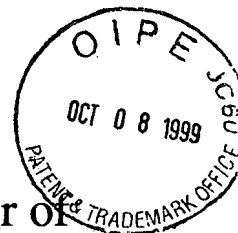


The United States of America



The Commissioner of Patents and Trademarks

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.

If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.

If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.

Bence Lehman

Commissioner of Patents and Trademarks

Pamela J. Motter
Attest

RECEIVED

OCT 13 1999



US005614737A

United States Patent [19]

Piccone

[11] **Patent Number:** 5,614,737[45] **Date of Patent:** Mar. 25, 1997[54] **MOS-CONTROLLED HIGH-POWER THYRISTOR**[75] **Inventor:** Dante E. Piccone, Glenmoore, Pa.[73] **Assignee:** Silicon Power Corporation, Malvern, Pa.[21] **Appl. No.:** 504,335[22] **Filed:** Jul. 19, 1995[51] **Int. Cl.⁶** H01L 29/74[52] **U.S. Cl.** 257/124; 257/107; 257/115;
257/119; 257/121; 257/133; 257/139; 257/146[58] **Field of Search** 257/107, 115,
257/119, 121, 124, 133, 139, 146[56] **References Cited****U.S. PATENT DOCUMENTS**

5,005,065 4/1991 Piccone et al. 357/38

OTHER PUBLICATIONS

Temple et al, MOS-Controlled Thyristor (MCT) Power Switches, No Date.

Power Conversion Intelligent Motion, Nov. 1992, pp. 9-16.

U.S. Application Ser. No. 08/381,766—Piccone et al filed Feb. 1, 1995.

Primary Examiner—Edward Wojciechowicz
Attorney, Agent, or Firm—William Freedman[57] **ABSTRACT**

This thyristor comprises a main current-carrying portion in the form of a semiconductor body having four layers, with contiguous layers being of different P and N conductivity types and with three back-to-back PN junctions between contiguous layers. One end layer constitutes an anode layer, an opposite end layer constitutes a cathode layer, and an intermediate layer contiguous with the cathode layer constitutes a gate layer. The cathode layer is divided into many elongated fingers, thereby dividing the PN junction between the cathode layer and the gate layer into many discrete PN subjunctions between the fingers and the gate layer. These subjunctions are effectively in parallel with each other so as to share the main current through the thyristor when the thyristor is "on". The gate layer has predetermined surface regions adjacent the cathode layer that are uncovered by the cathode-layer fingers and that respectively surround the PN subjunctions between the fingers and the gate layer. A gate electrode in ohmic contact with the gate layer in said predetermined surface regions of the gate layer surrounds the PN subjunctions between said fingers and said gate layer. The main current-carrying portion further comprises a cathode electrode having portions respectively registering with and in ohmic contact with the cathode-layer fingers.

10 Claims, 2 Drawing Sheets